April 15, 1958 W. H. BARRETT 2,830,555

ROLLER APPARATUS FOR COATING PAPER

Filed Oct. 29, 1954 3 Sheets-Sheet 1

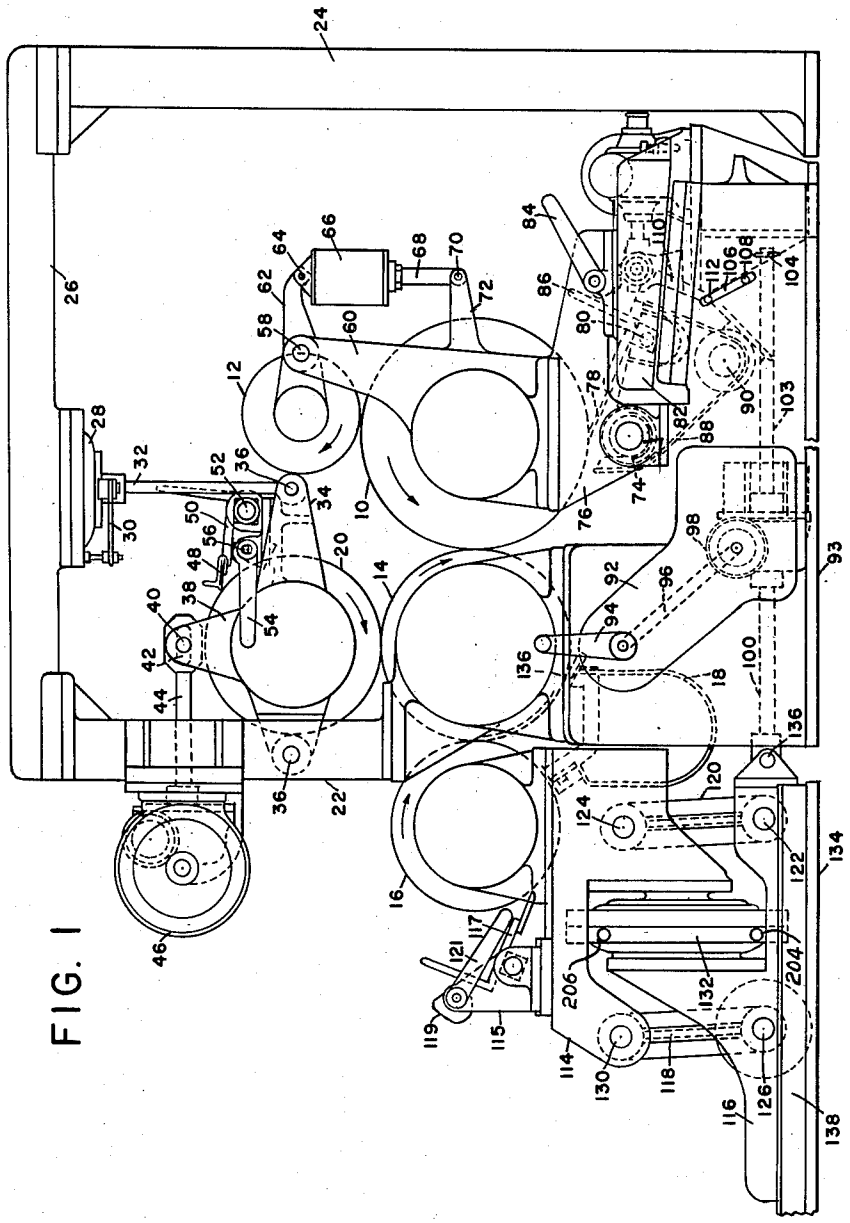

FIG. 1

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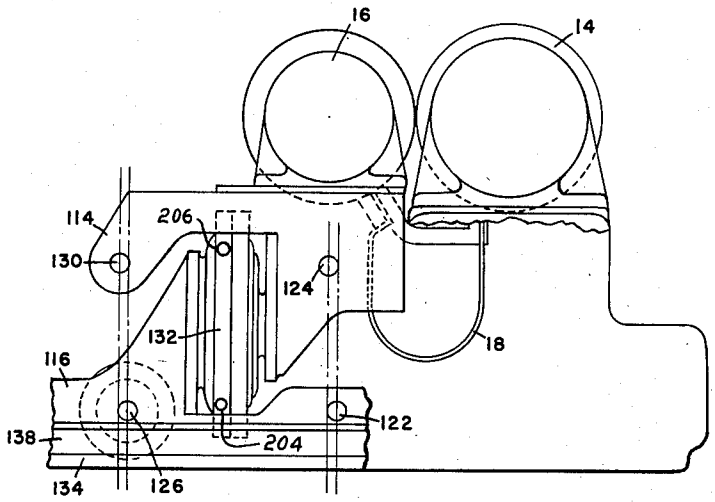

FIG. 2

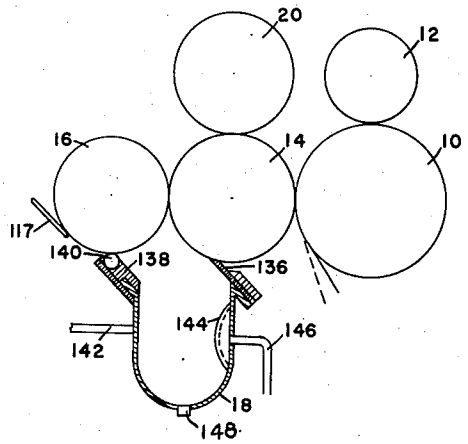

FIG. 3

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ROLLER APPARATUS FOR COATING PAPER

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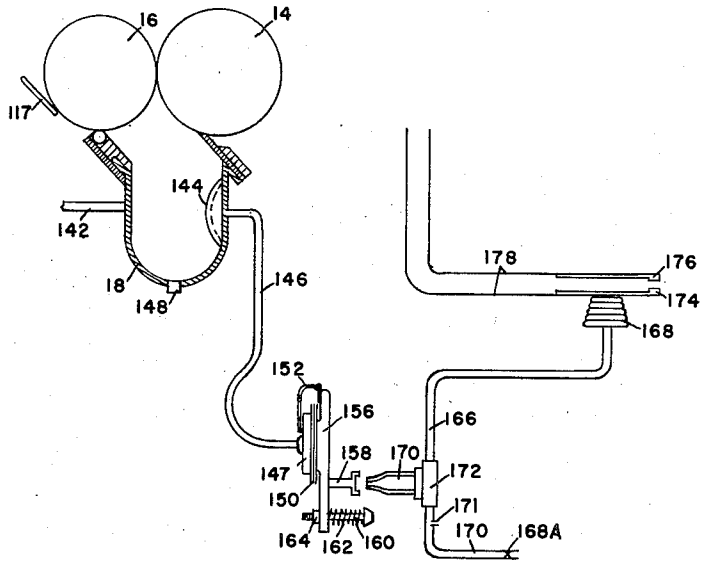

FIG. 4

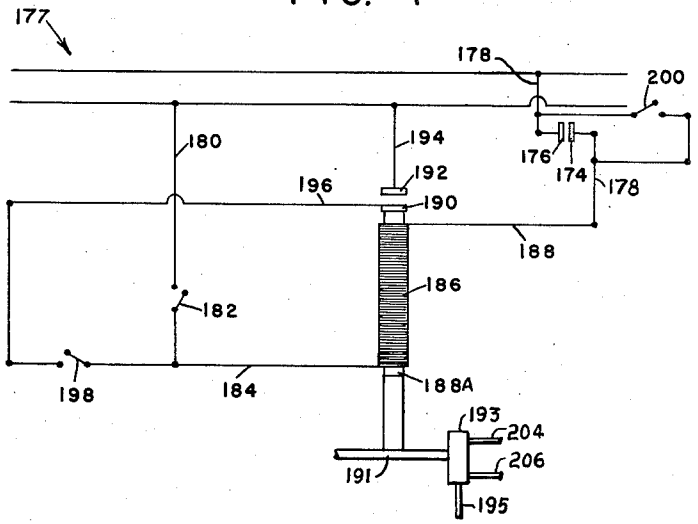

FIG. 5

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2,830,555

ROLLER APPARATUS FOR COATING PAPER

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Application October 29, 1954, Serial No. 465,693

8 Claims. (Cl. 118—7)

This invention is concerned with a paper coating apparatus and process to produce a coating having a superior surface in respect to smoothness, flatness, freedom from imperfections, and so forth. The base stock in web form may be of any suitable kind and the ingredients contained in the coating applied thereto may be chosen from a number of different materials. The coating mixture may include, for example, a mineral pigment such as clay, calcium carbonate, zinc sulfide, titanium dioxide, blanc fixé and the like or a combination of one or more of these materials and a binder such as starch, protein, casein, glue, or any other suitable material or a combination of the adhesive.

In the manufacture of paper for use as high-grade printing paper, it is customary procedure to apply to a paper web (base stock), a layer of aqueous suspension of mineral pigment and adhesive, generally organic adhesive. The web is then dried and finished in any manner desired. The paper so made is generally referred to as mineral-coated paper. The coating of paper with suspensions of mineral pigments has presented serious problems for the reason that such suspensions commonly used in the paper art do not often of themselves smooth out when applied even with slight irregularities. Heretofore, when paper was coated by a direct application of coating material, there was formed, unless special precautions were taken, ripples, lines, or other irregularities of the coating material on the paper, which when dried, produced defects such as streaks. Therefore, in much of the prior art practice, provision is made for smoothing out the ripples or other irregularities formed upon the application, either by the use of brushes, doctoring blades, or some smoothing or traveling rolls. Such aids, however, have the drawback that they are cumbersome and are responsible for the low rate of coating.

In view of these difficulties the present process proposes to apply a pre-determined or measured amount of coating material upon the traveling web of paper to be coated in such manner as to produce an even coating in the first instance and thus obviate the use of subsequent smoothing devices.

It is one of the principal objects of this invention to provide a process which will produce a coating of mineral or other pigment having a high degree of smoothness and uniformity in addition to the advantage of high output and reliable operation.

Another object of the invention relates to the use of coating color having high solid contents which can be applied to a fast moving web of paper. In general, the finer particle size of the mineral pigment, the better the color and finishing qualities. Clay, for example, from different sources, even in the same particle size groups, varies in degree of surface activity. This is important from the standpoint of high speed coating operation because it affects the degree of wetting in water, starch and the like slurries, and is a controlling factor

in flow properties which a given coating composition will have.

It can generally be stated that all adhesive mineral coating color compositions show thixotropic properties under certain conditions. With any given mineral coating composition, these properties become more pronounced with increasing solid contents. In other words, to avoid confusion, the terms used in describing coating color flow properties are hereinafter defined. Thixotropy is a reversible slogel structure shown by my colloidal suspension of high solid contents. When a thixotropic solution is agitated, the absolute viscosity becomes lower as the speed of agitation increases. When the agitation ceases, the solution will again gradually set to a firm gel. Dilatancy is the opposite of thixotropic properties. As the agitation or speed of shearing increases, the absolute viscosity increases. Unlike thixotropy, no time factor is involved in dilatancy.

Viscosity is the internal resistance of a fluid to flow. The absolute unit of viscosity is a poise. Fluidity is the reciprocal of viscosity. Plasticity is the rate of decrease of viscosity with the increasing rate of flow. A true plastic shows a definite yield point which is not the case with most coating materials. Another important phenomenon of thixotropic solution is that as the viscosity of the solution decreases by agitation, the rate at which the solution will give up its water to an absorbent medium, such as a web of paper, increases. This is a very important factor in paper coating, for it, in part, determines a rate at which the coating solution will wet the paper at the moment of contact, and this in turn influences the character of the coating film. It has been found in some coating processes that if the coating gives up water to the paper fast enough so that it becomes set (that is, no longer a fluid film) before leaving the nip of the applicator roll, the coating film will be rougher than if it is still fluid. This is due to the fact that as the film breaks away from the applicator roll, it is pulled into spherical droplets because of the force of surface tension and cohesion. In my process the shearing action results in the coating spreading on the flexible and resilient covered applicator roll in a substantially smooth and level film. When the coating on the applicator roll contacts the substantially dry web of paper, the water in the coating quickly wets the paper. The coating in the smooth film is transferred to the paper. The rubber or similar covered applicator roll assists in giving a clean smooth release of the coating from the applicator roll surface.

It has been found that as a color density increases, the surface sheen also increases and a better fiber coverage is obtained. It is highly desirable that the color density be controlled to obtain the most satisfactory results.

Mineral-adhesive coating compositions are thixotropic to a degree and at the higher solid contents is very important. This property is quite significant in the present method of coating paper. Definite advantages are obtained by applying coating of high solid contents. This may raise the question as to how high solid contents may go with a given mineral-adhesive combination. The answer would appear to be that the solid contents should not exceed the point where the coating begins to show a pronounced degree of dilatancy at high rates of flow. This point can be determined for any given composition by plotting the rate of flow against force or the viscosity against the rate of flow.

The doctoring roll is driven through a suitable medium such as a variable speed motor or Reeves drives so that the speed ratio betwen the doctoring roll and the applicator roll can be varied. This variable speed will give a great flexibility and control the coating weight.

It has been found that in order to obtain the smooth-

est coating film, it is necessary to keep the nip between the doctoring roll and the applicator roll flooded with a large excess of coloring material and maintain this excess of coloring material under substantially constant pressure. A number of ways may be used to accomplish this; and one way is the use of a variable speed motor driving a pump which forces the coating material into the fountain and maintain such coating material under super-atmospheric pressure. The variable speed motor should be tied into the main drive of the coating apparatus so that as the speed of coating changes, the speed of supply of coating material under pressure to the fountain is likewise varied. The maintaining of the coloring material under pressure at the nip between the doctoring roll and the applicator roll substantially, if not completely, eliminates the incorporating of air into the coating material in the form of bubbles. If bubbles are incorporated in the coating material they may go through the nip, causing skips and other irregularities to appear on the finished coating web.

Briefly described, the invention comprehends the passing of a web forwardly in step with the formation of a web on a paper machine or as a separate operation apart from the paper machine. Bringing the surface of the web of paper into contact with a rotating surface which may have a periphery speed substantially that of the speed of the web of paper, the rotating surface being adapted to apply coating material upon the surface of the web in a substantially fluid film, whereby any irregularities are eliminated by the flow of the coating material to a degree as it is being applied. After the coating material has been applied according to this process, no smoothing of the coating material is required.

In a coating apparatus of the kind shown in Patent No. 2,513,349 there is danger that the applicator roll may be damaged should the coating in the fountain become low or fail to be fed to the applicator roll. This invention includes means for preventing the damage to the applicator roll should, for any reason, the coating in the fountain fall below the amount required in the application of coating material.

Other objects and advantages of this invention will be apparent from the accompanying drawings and the following detailed description.

In the drawings:

Figure 1 is a side view in elevation of a single coating unit,

Figure 2 is a side view in elevation of a coating unit with a portion broken away showing the carriage supporting the doctor roll and the coating fountain,

Figure 3 is a diagrammatic view of a coater and including a fountain having the pressure diaphragm mounted therein,

Figure 4 is a diagrammatic view showing the doctor roll, applicator roll, fountain, and roll protecting means in the fountain, and

Figure 5 is a diagrammatic view of a circuit that may be used in connection with the roll protecting apparatus.

The apparatus and applicator permits paper to be coated at speeds from fairly low speeds to a speed of upward of 2,000 feet per minute and it is highly desirable that the apparatus for feeding the paper to the coating unit be of such construction that a continuous web of paper be supplied. If the coating unit is employed off the paper machine an automatic supplying device should be employed so that the paper from a new roll may be spliced to the end of a roll being coated while the coating unit is run at substantially normal speed.

It is to be understood that if it is desired to apply coatings of upwards of ten pounds or less per side, this may be accomplished with the apparatus shown in Figure 1 with a single application on each side. It has been found that smooth high weight coating can be successfully applied in one application but better results are obtained if two or more applications to the same side of the sheet is employed. The coating material may have a solid content varying over a considerable range but best results have been obtained where a mineral-adhesive slurry having a solid content in excess of 60% is employed. In fact, a coating composition having a solid content of 55% and upward with a viscosity falling within the range of 10,000 to 50,000 centopoises must be employed and the coating composition have thixotropic characteristics.

Paper from a suitable source of supply (not shown) is continuously fed to the apparatus shown in Figure 1. The paper comes in contact with the surface of the backing roll **10** and is held in close contact therewith pinch roll **12**. Coating composition in a preformed film is rolled on the surface of the paper under pressure as it reaches the nip area formed by the applicator roll **14** and the backing roll **10**. The backing roll **10** and the applicator roll **14** are squeezed together with considerable pressure so as to increase the normal nip area as shown in Figure 1. A doctor or spreading roll **16** is positioned a predetermined distance from the applicator roll **14** and coating material picked up by the applicator roll surface from the fountain **18** has shearing stress applied to it by the doctor roll **16** turning in a direction opposed to that of the surface of the applicator roll and at a different lineal speed. The shearing stress to the thixotropic coating controls the amount of coating carried by the applicator roll surface and results in the coating materials flowing into a substantially smooth film. Located above the applicator roll is a smoothing roll **20**. The purpose of the smoothing roll is to remove any unevenness in the preformed film and to remove any surplus coating above the desired amount. The coating unit is mounted in a suitable frame having upright members **22** and **24** and a horizontal extension member **26**. To the horizontal extension member is suitably attached pressure diaphragm member **28** which has a control means **30** operatively connected to the diaphragm **28**. Link **32** is pivotally connected to member **34** at **36** and the link is operatively connected to diaphragm **28**. The opposite end of **34** is pivotally connected to upright **22** at **36** and upwardly extended portion **38** of member **34** has an opening therein and in which is mounted rod **40**. Rod **40** passes through an elongated opening **42** in member **44**. When it is desired to lift the smoothing roll **20** from the surface of the coating material carried by the applicator roll, member **46** causes link **44** to move to the left and pin **42** operates through member **38** and **34** raises the smoothing roll upwards. The diaphragm **28** and the link **32** control the pressure that may be applied to the coating materials carried by the applicator roll surface, thus smoothing the coating and removing any surplus coating.

To remove any coating materials that may be picked up by the smoothing roll **20**, doctor blade means **48** contacts the surface of the smoothing roll. Doctor blade **48** is carried by substantially L-shaped holder **50** which is pivotally mounted on member **52**. A handle **54** is pivotally mounted on shaft **56**; the purpose of this handle is to raise the doctor blade from the surface of the smoothing roll when desirable or necessary and on movement of the handle the enlarged portion in dotted lines lifts the doctor blade.

The pinch roll **12** is pivotally mounted at **58** to members **60** by a pin extending through member **60** and link **62**. The pinch roll link **62** has pivotally mounted at **64** to a pressure control cylinder **66**. The purpose of the pressure control cylinder is to regulate the pressure applied to the paper on the backing roll **10** thus holding the paper on the backing roll surface under tension between the pinch roll and the nip area formed by the applicator roll and the backing roll. The pressure cylinder **66** has a piston rod **68** pivotally connected at **70** to link **72** carried by member **60**. The backing roll **10** is supported by members **60** which are pivotally mounted on

cross shaft 74 and the shaft 74 is supported by members 76.

Any coating materials picked up by the surface of the backing roll are removed by the doctor blade 78 which is pivotally mounted at 80 to members 82 so that the doctor blade normally contacts the surface of the backing roll 10. If it is desired to remove the doctor blade from contact with the backing roll surface, handle 84 with its enlarged end is moved to the left to lower the doctor blade 78. The doctor blade holder 86 is of sufficient weight to hold the blade in contact with the roll 10.

A container 88 is positioned below the backing roll so that any materials removed by the doctor blade are caught by such container. To remove the materials in the container 88, a screw conveyor 90 is mounted near the lower portion thereof.

Member 92 supported on member 93 has mounted near the upper end thereof a handle 94 which is operatively connected to cross shaft 98 by member 96. Cross shaft 98 is operatively connected to rod 100 and its extension 103. When the carriage supporting the doctor roll and the fountain is moved to the left under the influence of the handle 94, member 96 and cross shaft 98, the operating member 104, mounted on extension 103 of shaft 100, contacts the lower end of member 106 . Member 106 is pivotally mounted at 108 and hingedly connected at 112 to member 110, causing the backing roll 10 to move to the right in respect to the cross shaft 74. The backing roll supported by members 60 are pivoted on 74 and these support members are tied together with the cross shaft and a suitable toggle linkage (not shown) so that the backing roll face moves up in parallelism with the face of the applicator roll. The actuating force may be applied to the backing roll support by means of an air operated diaphragm or other suitable means.

The applicator roll 14 has a resilient surface and may be rubber covered or may be covered with other suitable material. To prevent the fountain from damaging the rubber surface of the applicator roll 14, the fountain 18 and the doctor roll 16 are supported on and carried by a tiltable and movable carriage. The carriage includes top members 114 and bottom members 116 and connecting arms 118 and 120. The arms are pivoted to the bottom member at 122 and to the top member at 124. The pivot point member 122 is closer to the center line of the applicator roll 14 than is the pivot point 124. Arms 118 are pivoted at 126 to the bottom member 128 and to the top member 114 at 130. The pivot point 126 is closer to the center line of the applicator roll 14 than is the pivot points 130. The purpose of this arrangement will be hereafter more fully described.

Supported by members 114 are support members which carry pivotally mounted doctor blade 117. The doctor blade may be forced from the doctor roll 16 surface by means of enlarged portion 119 of member 121.

When it is desirable or necessary to separate the doctor roll 16 and the applicator roll 14, the pressure in the bellows 132 is changed which permits the top of the carriage member 114 to swing downward and then to the left moving with it the doctor roll 16 and the fountain 18.

If it is desired to wash the coating apparatus or to separate the roll for any other purpose, the carriage is moved to the left on track 134 through the movement of the handle 94, member 96 and cross shaft 98 which is operatively connected to the shaft 100 which in turn is connected to the carriage at 136.

In Figure 2 it is clearly shown that the pivot points 122 and 126 of the links or arms 118 and 120 on the lower member are closer to the center line of the applicator roll than points 124 and 130. The diaphragm 132 is supported by the member 116 and when in the expanded position presses against member 114.

Figure 3 shows a section of the fountain in which doctor member 136 is connected to the fountain and contacts the surface of the applicator roll 14. The opposite side of the fountain is sealed by doctor 138 which has mounted therein a rotatable rod 140. Rod 140 may be driven or it may be rotated by contact with the doctor roll surface 16. The opposite sides of the fountain are sealed and generally seals of type shown in Patent No. 2,513,394 are used. Coating materials flow to the fountain preferably under the influence of pump (not shown), a suitable way is through conduit 142. The coating material flows to the fountain under pressure and is maintained in the fountain under pressure so that the nip formed by the doctor roll 16 and the applicator roll 14 is flooded. Mounted in the fountain is diaphragm 144 and communicating with the diaphragm space is fluid pressure pipe 146. If for any reason the coating in the fountain is to be removed other than by application to the applicator roll, a controlled opening 148 is provided. The diaphragm 144 is sealably connected to the inner surface of the fountain 18. When the fountain is filled with coating and the pressure is being maintained the diaphragm takes the position shown in dotted lines in Figures 3 and 4. The fluid pressure line 146 which connects with the diaphragm 144 at one end and at the other end is connected with diaphragm housing 147 which has diaphragm 150 mounted therein. Connected to housing 147 is member 152 which is hingedly connected to member 156. The diaphragm 150 when it expands, forces member 156 to the right (Figure 4). Air check means 158 is supported by member 156 and moves upon the movement of the diaphragm 150. To control the amount of pressure required to move the member upon expansion of diaphragm 150 a rod-like member 160, supported from member 92, upon which is mounted spring 162. The free end of the rod 160 is threaded and the nut 164, depending upon the direction it is turned places more or less tension on spring 162. The tension on the spring 162 is adjusted in accordance with the pressure which is to be maintained in the fountain. When the pressure in the fountain 18 falls below the desired point, member 158 is moved to the left and the air normally flowing through the pipe 166 to bellows 168 escapes through member 170. Member 170 is connected to and extends from member 172. Air flowing through the pipes 166 is controlled by pressure regulating valve 168A located in pipe 170. Also in this pipe 170 is air bleed orifice 171. When the member 158 closes the outlet in 170, air flows through 170, 172 and 166 and into bellows 168 which close the contacts 174 and 176. When the contacts 174 and 176 are closed, current flows through the conductors 178 and line 188 then through solenoid 186 which operates the control means for the pressure in diaphragm 132. When these contacts are open the current flowing to the control means for the diaphragm 132 is interrupted and the pressure in the diaphragm is changed and this permits the tilting means carrying the doctor roll 16 to move the roll away from the surface of the applicator roll 14. The means for controlling the pressure in the diaphragm 132 may be any known suitable means such as shown in Patent No. 2,138,397, particularly as pointed out on page 2, lines 20 to 48.

Shown in Figure 5 is an electrical diagram that may be used in connection with means for protecting the surface of the applicator roll. The main line 177 has connected thereto conductor 180. In this line is mounted switch 182 which is normally open. The current flowing through the conductor 180 when the switch 182 is closed passes through conductor 180 and through solenoid 186, conductor 188, contact points 174 and 176. The flow of the current through the solenoid 186 causes the core 188A to close the contacts 190 and 192. Current from the line 178 then flows through conductors 194, 196, switch 198, which is normally closed, and through the solenoid back to the other side of the line. When

this occurs, the switch **182** is released so that it opens. When the coating apparatus is to be washed or for some other reason the rolls are to be separated, switch **200** is closed and the current will by-pass the switch formed by contacts **176** and **174**. The movement of the solenoid core **188A** operates the control for the bellows **132**. The core **188A** is suitably connected to four-way fluid valve means **193**.

In operation mineral adhesive coating materials such as starch, casein, protein, and pigment such as clay, calcium carbonate, etc., having a solid content in excess of 55% and a viscosity of about 10,000 to 50,000 centipoises flows under pressure into the fountain **18**. This pressure forces diaphragm **144** to the position shown in dotted lines in Figure 4. Member **158** closes the outlet to member **170** and the fluid from pipe **170** flows to the bellows **168** closing the contacts **176** and **174**. Then the coating apparatus may be put in operation. Should the pressure on the coating in the fountain **18** become lower than the predetermined pressure desired or the coating material fail to be delivered to the fountain diaphragm **144** takes the position shown in Figure 4 in full line. This permits the fluid in line **146** to flow into the diaphragm **144** and remove the pressure against diaphragm **150**, the tension of spring **162** moving member **156** to the left. This permits fluid being delivered to the diaphragm **168** to escape through **170** and when this occurs the bellows **168** are deflated and contacts **174** and **176** open. When the contacts **174** and **176** open the pressure control means **132** operates permitting the carriage supporting the backing roll to move away from the applicator roll surfaces.

The solenoid core **188A** may be, as shown, connected to valve handle **191**. The fluid from the source of supply flows through the valve **193** and conduits **206** to the diaphragm **132** and when this diaphragm is moving to the non-operating position the fluid flows through conduit **204** and in turn through the valve **193** back to the source of supply.

It is preferred that the pressure of the coating material at the nip between the doctor roll and the applicator roll fall within the range of about what would be equivalent to one to four feet head of water, preferably about a pressure equivalent to two feet head of water. As the doctor roll is positioned a predetermined distance from the applicator roll surface, a given amount of coating material is left upon the surface of the applicator roll and as the coating material has a high solid content and has thixotropic properties, the turning of the doctor roll at a predetermined speed and in a direction different from the direction of rotation of the applicator roll there is set up a stress or shearing in the coating and results in color flowing into a smooth film. The coating may have some imperfections in the preformed film and this is removed by the smoothing roll which may remove some of the coating material also. The preformed smooth film comes into contact with the web of paper which preferably does not contain more than about 10% of moisture. The coating is applied under rolling pressure to the web of paper and the thixotropic coating under pressure becomes dilatant. This insures the smooth film upon the web of paper containing low moisture content. The problem of drying the moisture from the coating material is far less than by any prior known process.

The diaphragm **144** and conduit **146** are filled with fluid and when coating under pressure fills the fountain **18**, part of the fluid in diaphragm **144** is forced through the line **146**, the diaphragm taking the position shown in dotted lines in Figure 4. The flow of the fluid from the diaphragm **144** through the line **146** causes the fluid to flow into the diaphragm **150**, expanding it. The expansion of the diaphragm **150** which causes plate **156** and closure member **158** to move to the right from their position shown in Figure 4. This movement to the right causes closure member **158** to close the outlet in the restrictive air flow member **170** and at the same time member **156** compresses spring **162**. When the closure member **170** closes the outlet end of member **170**, the fluid or air which is escaping through **170** is forced to travel through lines **166** to bellows **168**. The air flowing into bellows **168** causes it to expand raising contact **174** against contact **176**. The contacts **174** and **176** are of any suitable type of electrical contacts. These contacts will remain closed as long as the air is being furnished to bellows **168**. It has been found that air bleed opening **171** in the air pipe results in better operation than when omitted. If pressure in the fountain **18** falls below a predetermined amount, the spring **162** forces member **156** to the left, Figure 4, causing the fluid in diaphragm **150** to flow back through the line **146** into the diaphragm **144**. When the bellows **168** collapse the electrical contacts **174** and **176** open.

The coating apparatus requires a fountain in which a pool of coating material is maintained. In the fountain is mounted means which upon a predetermined change of coating material pressure thereon results in opening the electrical circuit to control means for maintaining pressure between the doctor roll and the applicator roll.

What is claimed:

1. In a coating apparatus comprising a backing roll, an applicator roll and a doctor roll, said three rolls mounted in substantially the same horizontal plane, a fountain having an open top positioned below and directed toward a portion of the applicator roll and a portion of the doctor roll forming a closed coating container, means for forcing coating material into the fountain under super-atmospheric pressure, a smoothing roll mounted above the applicator roll for smoothing coating carried by the applicator roll, a pinch roll mounted to rotate in contact with the surface of paper on the backing roll whereby paper passing over the backing roll is held under tension on the surface of the backing roll, the said doctor roll and fountain mounted on a horizontal moveable carriage, said moveable carriage including a top member and bottom member, said top member and bottom member hingedly connected together, the top member carrying the doctor roll and the fountain, means for maintaining pressure between the doctor roll and the applicator roll, and means for releasing the pressure between the doctor roll and the applicator roll upon the lowering of the pressure on the coating color in the fountain, whereby the doctor roll and fountain will swing away from the applicator roll surface without damage thereto.

2. In a coating apparatus comprising a backing roll, an applicator roll for applying coating to paper carried by the backing roll, a doctor roll for controlling the amount of coating on the applicator roll, said backing roll, applicator roll and doctor roll mounted in substantially the same horizontal plane, a fountain directed toward and mounted adjacent a portion of the doctor roll and a portion of the applicator roll so that the backing roll, applicator roll and doctor roll and fountain form a closed coating material container, a smoothing roll mounted above the applicator roll for smoothing coating material thereon, means for applying pressure to the smoothing roll and means for separating the smoothing roll from the applicator roll, and a diaphragm means mounted in the fountain and operatively connected to the doctor roll, whereby the doctor roll may be moved away from the surface of the applicator roll under predetermined conditions.

3. In a coating apparatus comprising a backing roll, a resilient covered applicator roll and a hard surface doctor roll, said three rolls positioned in substantially the same horizontal plane, a fountain having an open side positioned below and directed toward a portion of the doctor roll and a portion of the applicator roll, means for sealing the four sides of the fountain, said means including on one edge of the fountain a doctor means contacting the applicator roll and a doctor means on the opposite side of the fountain and having mounted therein

a rotatable rod member contacting the doctor roll surface, means for forcing coating material under pressure to the fountain and maintaining said coating material in the fountain under pressure, a moveable carriage supporting the doctor roll and the fountain, means mounted in the fountain for controlling the movement of the doctor roll upon the lowering of the pressure a pre-determined amount in the coating material in the fountain.

4. A coating apparatus including an applicator roll, a doctor roll for spreading coating on the applicator roll surface, actuatable means for maintaining pressure between the surface of the applicator roll and the doctor roll, means for maintaining a pool of coating material between the applicator roll and the doctor roll, pressure responsive means including a diaphragm actuated by change in the pressure in the coating material mounted in the pool of coating material for actuating said pressure maintaining means for releasing the pressure between the applicator roll and the doctor roll upon a predetermined condition of the coating in the fountain.

5. In a coating apparatus comprising a backing roll, a resilient covered applicator roll, a doctor roll having a hard surface, the three rolls arranged in substantially horizontal plane, a fountain being positioned adjacent and directed towards a portion of the doctor roll and a portion of the applicator roll to form a closed coating container, sealing means carried by the fountain, said sealing means including a doctor blade contacting the applicator roll surface and a rotatable rod contacting the doctor roll surface, means for forcing coating material under pressure into the fountain and maintaining said coating material in the fountain under pressure, a pressure responsive means in the fountain adapted to be actuated by changes in the coating material in the said fountain, a tiltable and movable carriage supporting the doctor roll and the fountain, means for moving said carriage substantially horizontally, smoothing means mounted above the applicator roll for smoothing coating material carried by the applicator roll, a pinch roll mounted above the backing roll for holding tension on the paper being coated, means for squeezing the backing roll and the applicator roll together to increase the nip area, actuatable means for maintaining pressure between the surface of the doctor roll and the applicator roll, said pressure responsive means in said fountain actuating said actuatable means for releasing the pressure between the doctor roll and the applicator roll upon a predetermined condition in the coating material.

6. In a coating apparatus, a roll assembly comprising, a roll mounted on a main frame and arranged to apply the coating composition to a web of paper while being supported on the surface of a second roll, and a third roll positioned on the opposite side of the coating applying roll to that of the said second roll, means for maintaining a pool of coating composition adjacent the applying roll, a pressure responsive diaphragm mounted in the pool of coating composition and adapted to respond to changes in the coating composition, a pivotally mounted frame for supporting the second roll, a movable frame having top and bottom portions, means on the bottom and top portions of the movable frame providing pivotal points for the top portion of the said movable frame, pivotally mounted arms connecting said top and bottom portions of said movable frame at the pivotal points, said third roll mounted on the top portion of said movable frame, said pivot points of the bottom portion of the movable frame mounted along a line laterally offset from the pivotal points on the top portion of said movable frame, whereby pivotal movement of said top portion of the movable frame with respect to the bottom portion of said movable frame will cause said third roll to move away from the coating applying roll, said third roll having a center of gravity when said rolls are in operative engagement displaced from the pivotal points of the lower portion of said movable frame in the direction which urges the third roll out of operative engagement, actuatable means for maintaining pressure between the coating applying roll and said third roll, said pressure responsive diaphragm in response to changes in the coating composition actuating said actuatable means.

7. In a coating apparatus, a roll assembly, one of said rolls carried by a main frame and arranged to apply the coating composition to one side of a web of paper while being supported on the surface of a second roll, and a third roll positioned on the opposite side of the coating roll to that of the said second roll, a tiltable and movable frame having top and bottom portions, said frame movable substantially horizontally, means for moving said tiltable and movable frame substantially horizontally, means on the bottom and top portions of the movable frame providing pivotal points for the top portion of the said movable frame arms connecting the upper and lower portions of said tiltable frame, said third roll mounted on the top portion of the movable frame, means mounted on the movable frame for supplying coating composition to the roll for applying coating composition, said pivot points of the bottom portion of the movable frame mounted along a line laterally offset from the pivotal points on the top portion of said movable frame, whereby pivotal movement of said top portion of the movable frame with respect to the bottom portion of said movable frame will cause said third roll to move away from the coating applying roll, said third roll having a center of gravity when said rolls are in operative engagement displaced from the pivotal points of the bottom portion of said movable frame in the direction which urges the third roll out of operative engagement.

8. In a coating apparatus having a main frame and a tiltable and movable frame, a roll assembly comprising a series of rolls, one of said rolls mounted on the main frame and arranged for applying coating composition to a moving web of paper, said tiltable and movable frame having top and bottom portions, said frame movable in a substantially horizontal plane, means for moving said movable frame, one roll of said roll assembly for smoothing coating composition on the applying roll mounted on the top portion of said tiltable and movable frame, means on the top and bottom portions of the said frame providing pivotal points for tilting the top portion of said frame, arms connecting the pivotal points of the top and bottom portions of said movable frame, means mounted on the top portion of said frame for supplying coating composition to the roll applying the coating composition to the paper, said pivotal points of the bottom portion of said frame positioned laterally offset from the pivotal points on the top portion of said tiltable and movable frame, whereby movement of the top portion of the said tiltable and movable frome with respect to the bottom portion of said frame will cause the roll carried by the top portion of said frame to tilt away from the roll carried by the main frame.

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